Unit 4 Ecosystems

How organisms react with each other and their environment

Goals for the unit

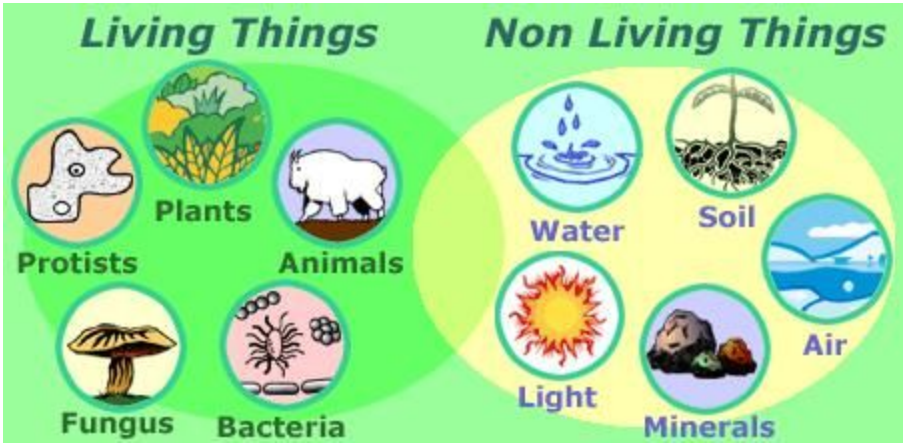
HS-LS2-1 **Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.**
HS-LS2-2 **Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales**
HS-LS2-6 **Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.**

What is an Ecosystem?

- An ecosystem is a group of different organism interacting with each other and their physical environment
- Consists of two factors:

- **Biotic factors** – things that are living (plants, animals, bacteria, fungi)

- **Abiotic factors-** things that are nonliving (rocks, rain, sunlight, dirt)



How are ecosystems organized?

- Ecosystems are organized by how many different types of species are interacting with each other
- Levels of organization from smallest to largest

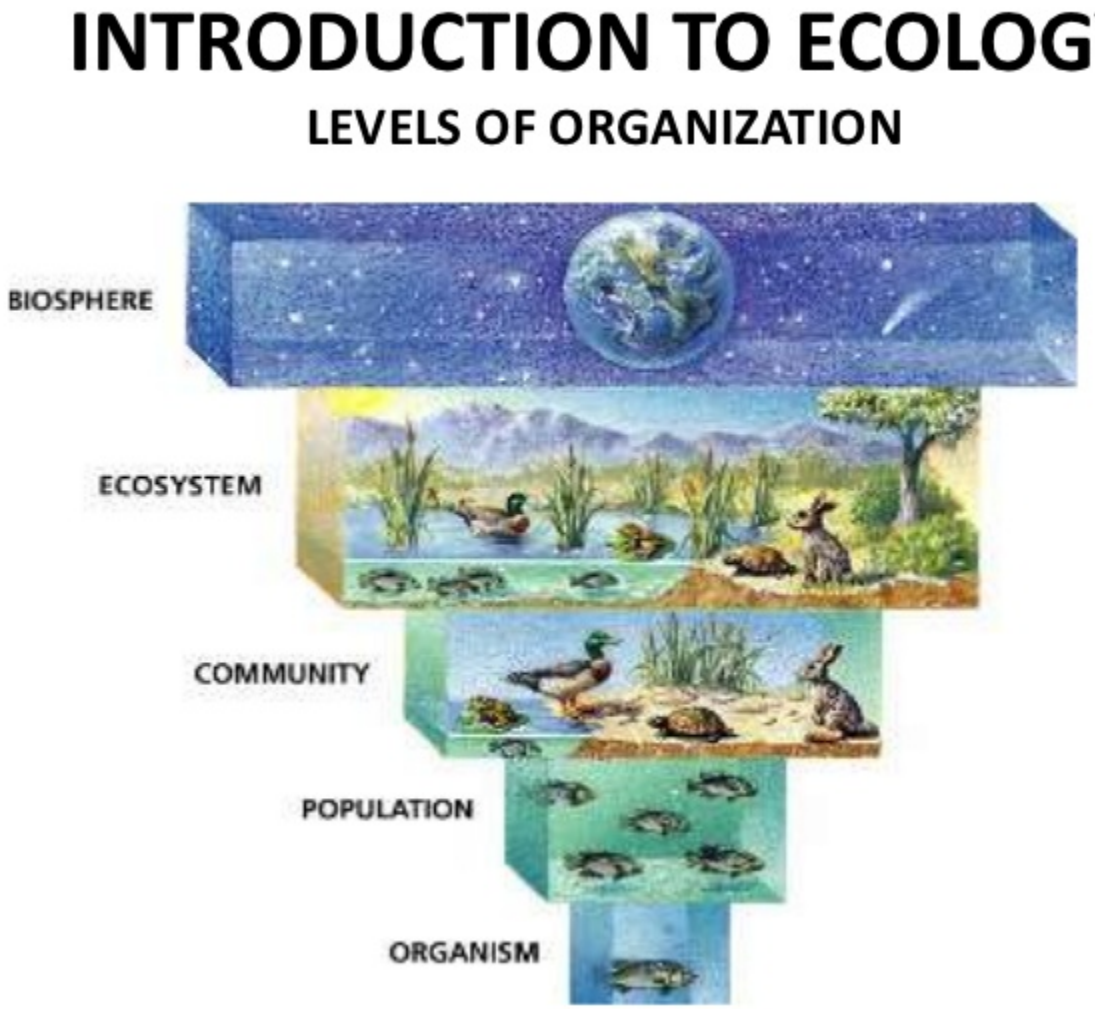
Organism- 1 living thing (smallest)

Population- a group of the same organisms

Communities- two or more groups of different organisms

Ecosystems- all living and non-living things in a given area

Levels of Organization



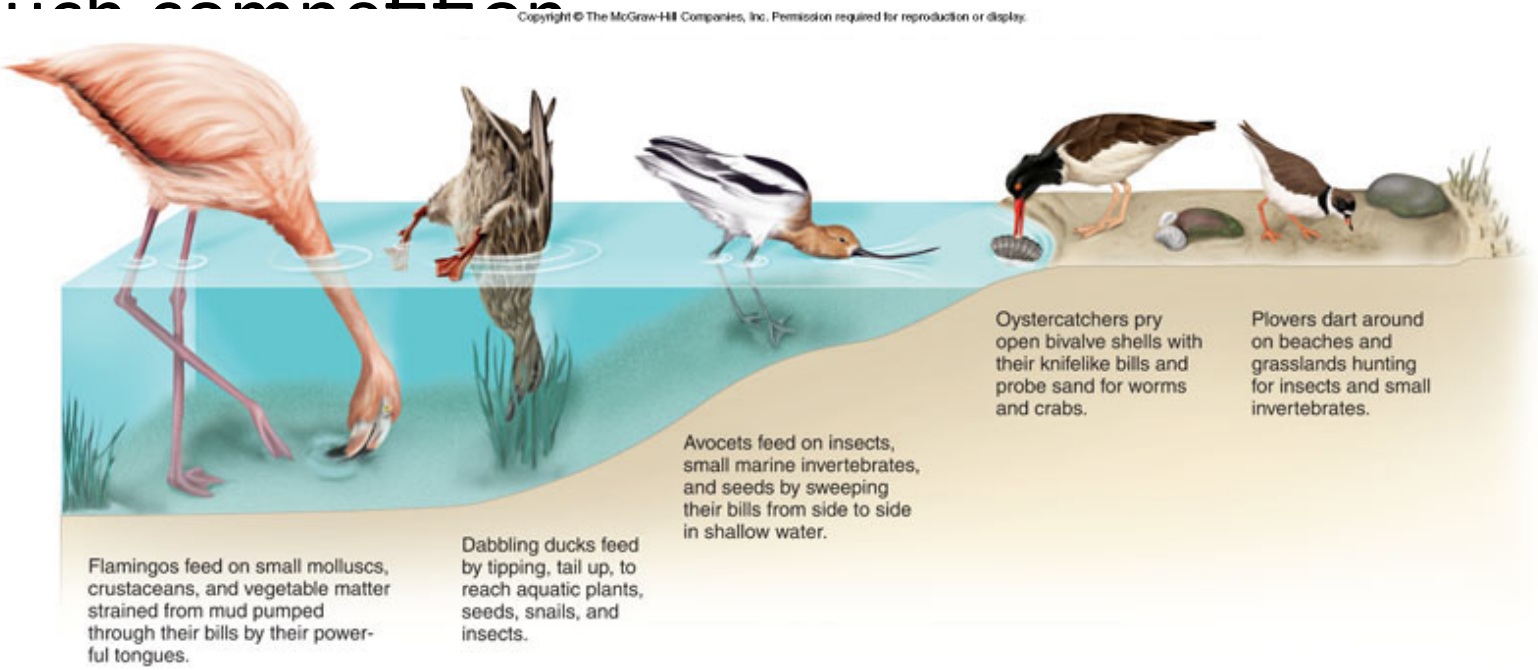
Where organisms live and what they do

- A **habitat** is the place that an organism lives

- A **niche** is the role an organism has in the environment
  - A niche is usually defined by what the organism eats, where it lives, and how it reproduces

Niche

- No two organisms can occupy the same niche. Each organism must have slight variances in their niche otherwise there would be too much competition.



Relationships among Organisms

- Organisms can have many different types of relationships with each other:

- Symbiotic relationships
- Predator-Prey relationships
- Competitive relationship

Symbiosis

- A close interaction between two or more different types of organisms
- Three types:

- Mutualism
- Commensalism
- Parasitism

Mutualism

- When both species benefit from the relationship
- Both are getting s

Commensalism

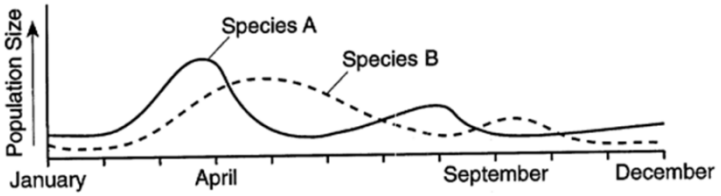
- A relationship in which one species benefits and the other is not affected
- One gets something good while the other doesn't get hurt or anything good (+ Ø)

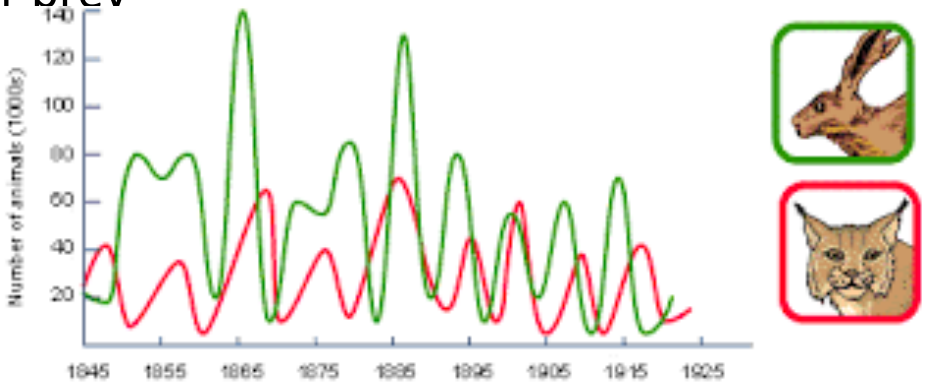
Parasitism

- A relationship in which one organism is benefiting while the other is getting harmed
- One is getting something good while the other is hurt from the rela

Predator- Prey Relationship

- A predator is an organism that eats another organism. The prey is the organism which the predator eats.
- If the prey population increases, so does the predator population
- If the prey population decreases then the predator population will also decrease
- Predators are dependent on their prey





Competition Relationships

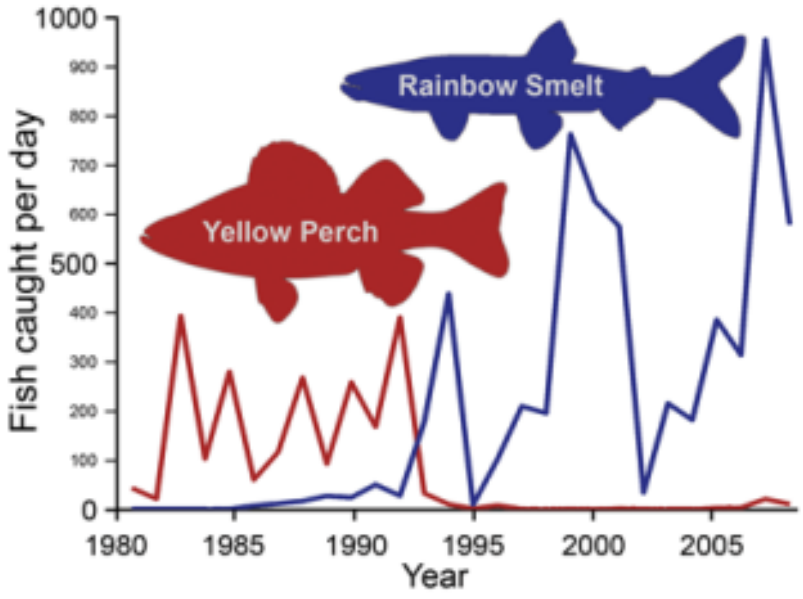
- Some organisms compete with other organisms for resources like food, water mates, and space.

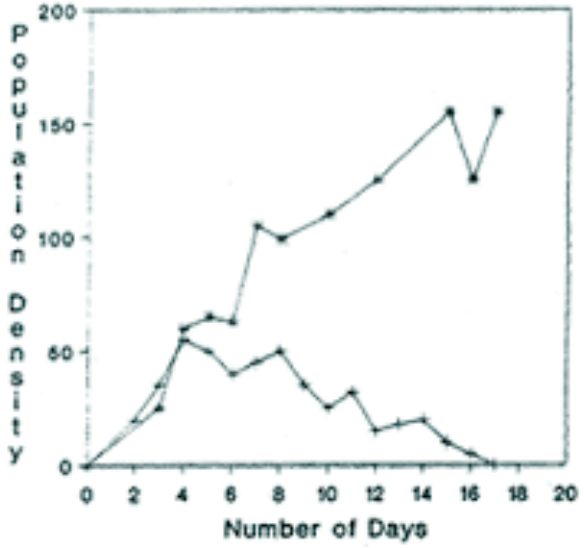
- In competition relationships one species or organism will win out over the other.
- This causes on species to thrive, grow, and reproduce, while the other species may decrease or die out all together

Competition graphs

When species fight over food, habitat, water and other resources, you can see that usually one population is more successful and therefor the population will increase

This is also why no two species can occupy the same niche



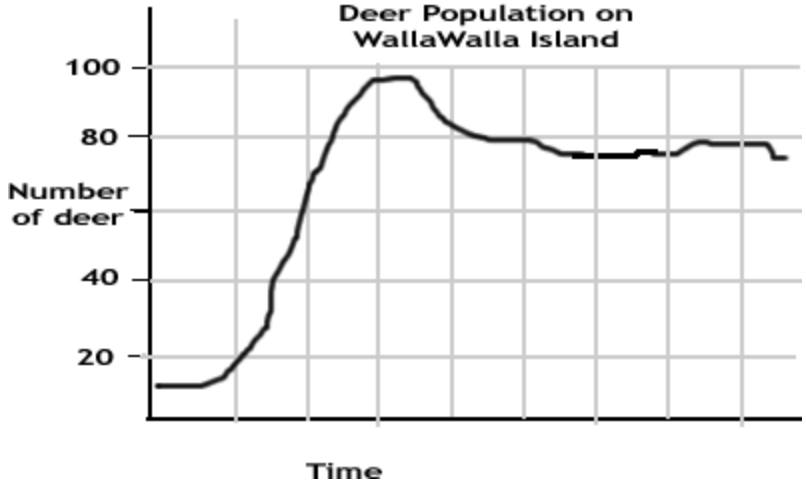


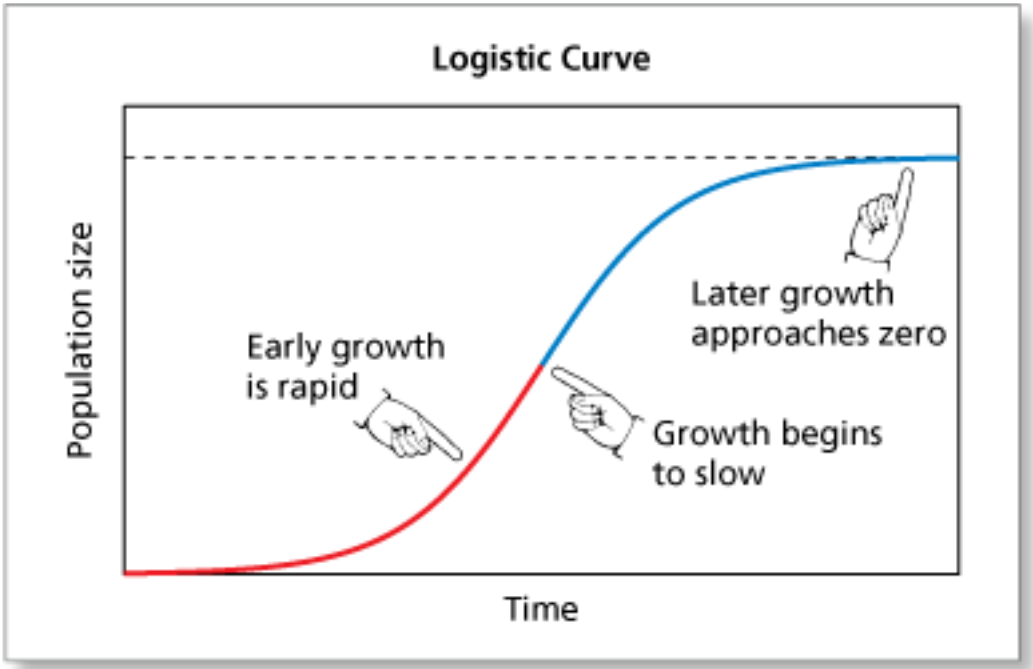
Factors affecting populations

- There are many things that can affect the size of a population
- A limiting factor is something that limits the size of a population
    - Examples of limiting factors are: food, water, predators, temperature, land availability, and availability of mates
- Once a population has reached it's maximum size, it is said to be at carrying capacity

Carrying Capacity Graphs

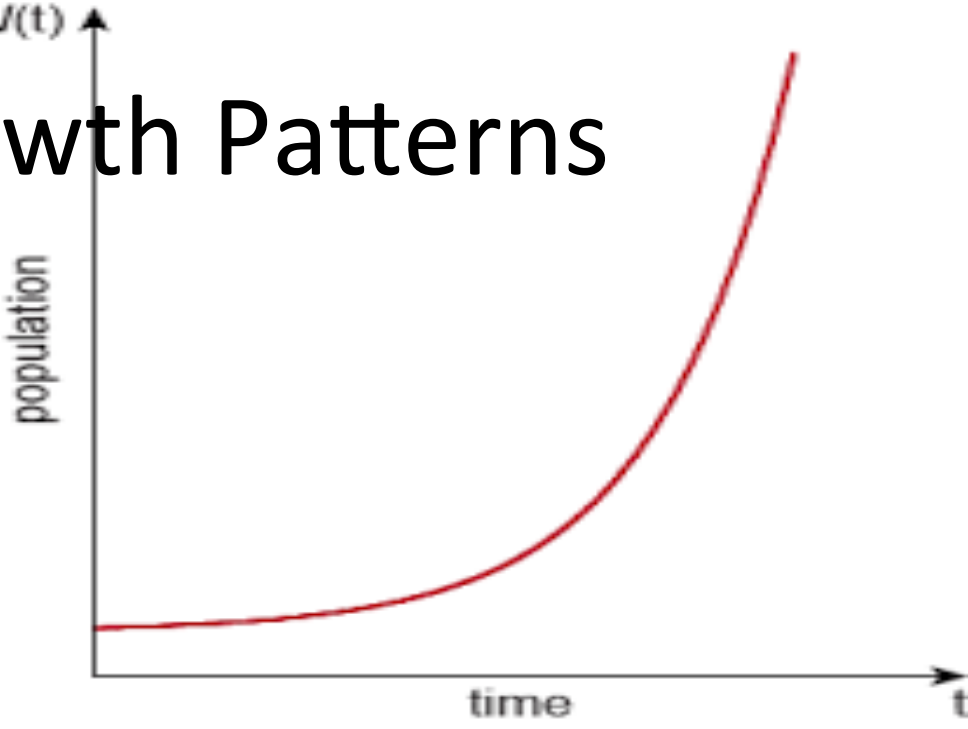
Carrying capacity graphs shows the populations increasing until a certain point and then mostly evening out.

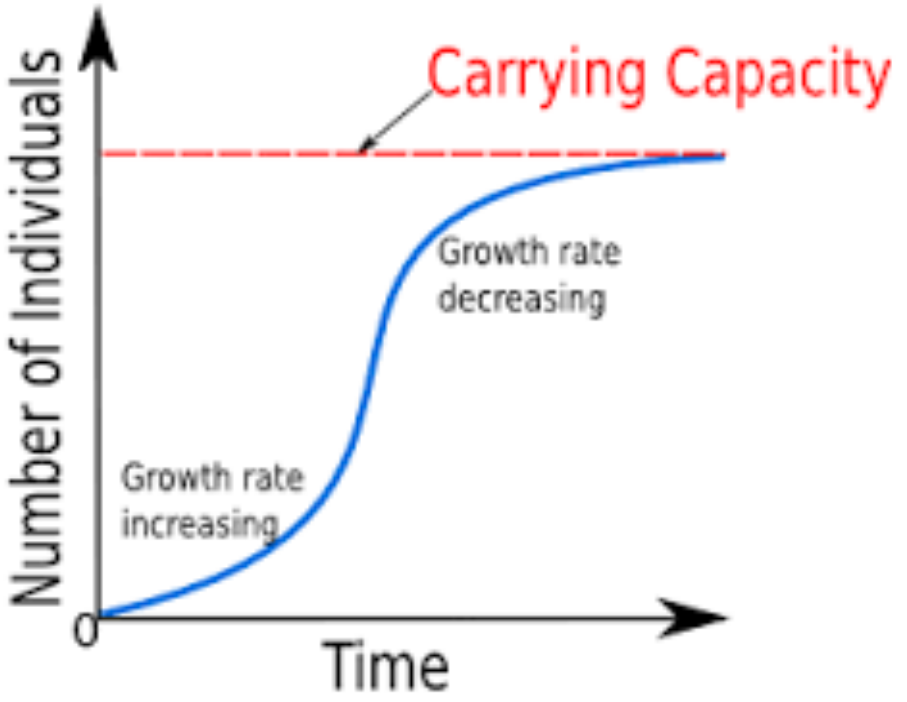




Population Growth Patterns

- **Exponential growth** – population grows when resources are unlimited, populations resulting in a J-shaped curve
- **Logistic growth -** when resources are limited, populations leveling off when the carrying capacity of the environment is reached, resulting in an S-shaped curve





Population Density

- The amount of the same organisms in a given area is known as <u>population density</u>.

- Formula:

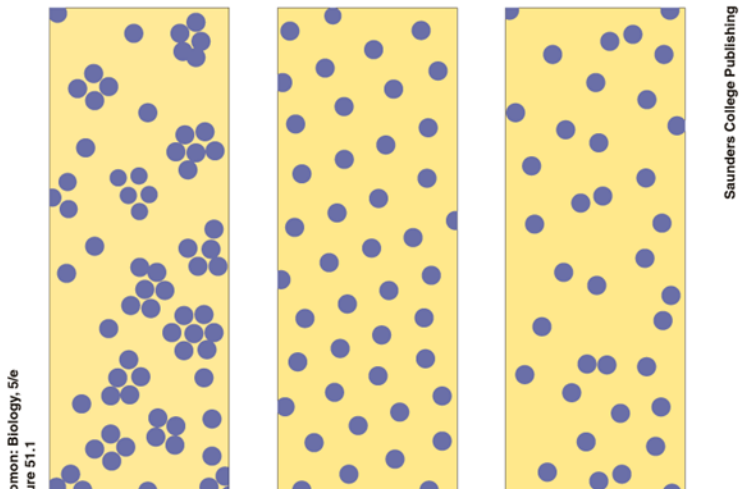
Population density = $\frac{\text{number of organisms}}{\text{area}}$

Population change can also affect the number of organisms in an ecosystem. It can be calculated as:

Population Change = (Birth rate + immigration) – (death rate + emigration)

Immigration = coming into a population

Emigration = leaving a population



Ecosystems, Populations and Change

- One of the most important things to understand is how populations respond to changes in the environment

- If an ecosystem is stable (very little change) then populations in that ecosystem will be fairly constant
- This is the ideal ecosystem with average resource availability

Ecosystems, Populations and Change

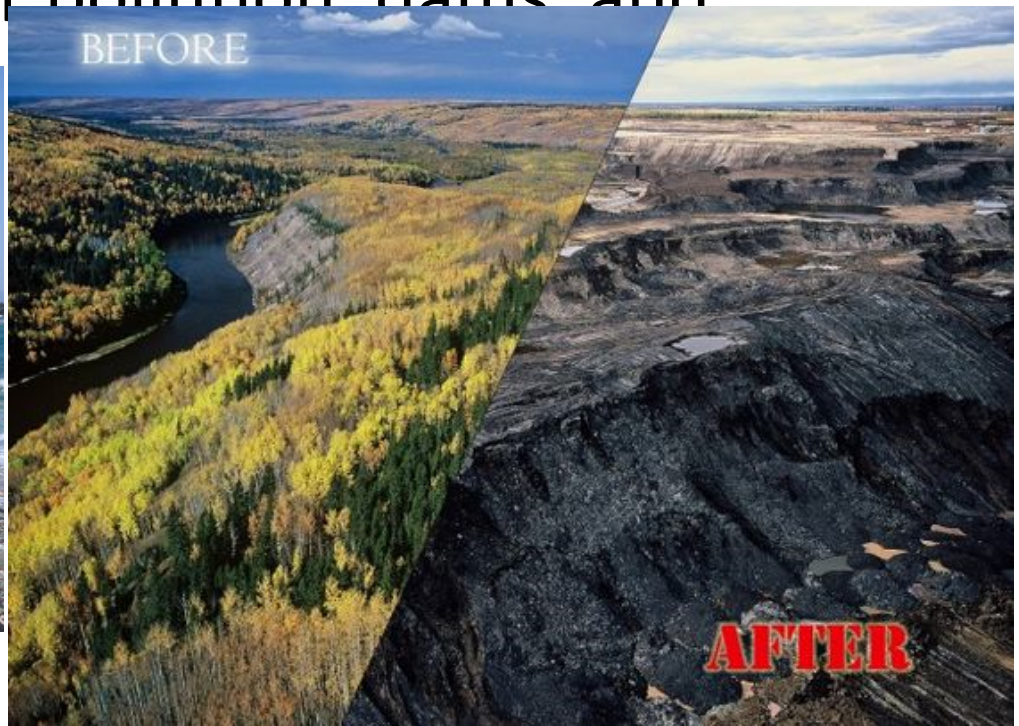
- If there is some change in an ecosystem, then some populations may be affected, but most can bounce back

- However, is there is extreme change to the ecosystem, then populations destabilize and can decrease even to a poi

Ecosystems, Populations and Change

- When ecosystems undergo extreme changes, the habitat of most animals is destroyed, along with food availability and other resources

- Changes can be caused by climate, extreme weather, fires, water pollution, dams, and industrialization



Succession

- Succession is the gradual process by which ecosystems change and develop over time. Nothing remains the same and habitats are constantly changing.